

In Situ Real-time Ice Calving Event Detection

Problem

- Ice calving is a process of ice breaking off an ice sheet creating icebergs
- Ice sheet models such as BISICLES must detect and remove icebergs in real time to avoid mathematical ill-posedness of the models
- Existing approaches do not scale well, which is important for solving realistic problems

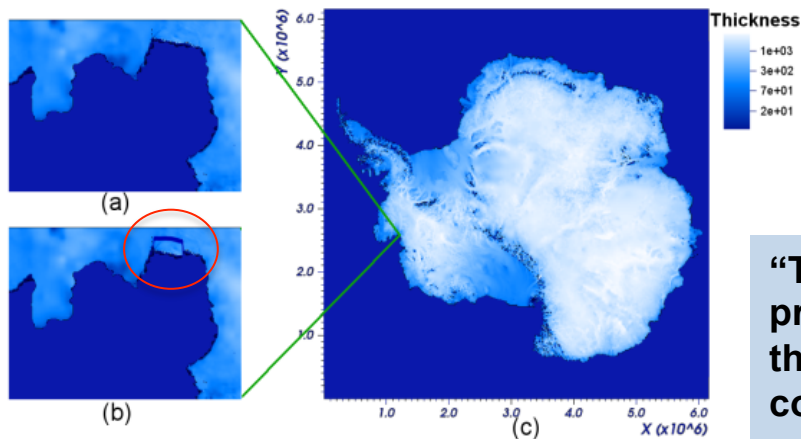
Approach

- Developed a novel AMR-aware Parallel Connected Component Labeling (PCCL) algorithm
- PCCL identifies connectivity at each AMR level in parallel, propagates “groundedness” across AMR levels, and performs communication-efficient hierarchical aggregation among MPI processes

Achievements

PCCL is capable of real-time detection of ice calving events in BISICLES code and removes scaling bottlenecks at high concurrencies **6X faster** than the existing detection algorithm

“The AMR-aware PCCL scheme is more efficient than our previous approach and removes a scaling bottleneck for the BISICLES code, which was becoming apparent at high concurrencies. This will improve BISICLES usefulness for understanding the Antarctic response to climate forcing, including its contribution to sea level rise.” - Dan Martin, BISICLES lead, LBNL



An example of an ice calving event on the Pine Island Glacier ice shelf



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